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Home Storage of Vegetables and Fruits

Revised by
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The production of home grown vegetables and fruits in Ohio has grown to large proportions during the last year or two. Home gardens have been improved, enlarged, and greatly increased in number. Existing fruit trees have been pruned, sprayed, and cared for. New plantings of small fruits have been made and brought to maturity. The volume of these home grown foods is an important factor in the economic and nutritional situation confronting every community and every family in the present war emergency.

If the full nutritional values of these products are to become available on the family table throughout the year, proper methods of saving the surplus must be utilized. This is particularly true of vegetables and fruits which lose their quality rather quickly, if not properly preserved. There are several methods of preserving surplus vegetables and fruits, such as canning, drying, freezing, and storing.

Storing is the cheapest method of preservation, and is adapted to the less perishable products from the garden and orchard.

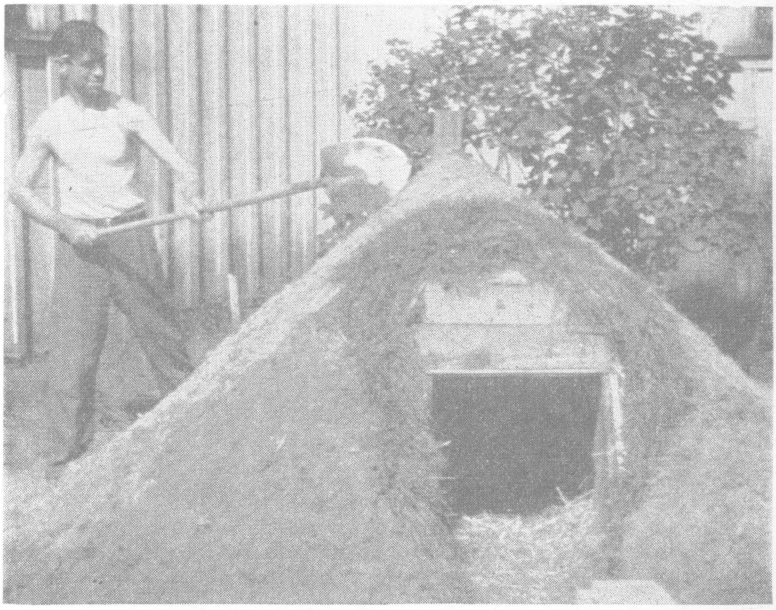

Fig. 1.—A home-made utility pit for everyday use, suitable for storing potatoes, apples, carrots, beets, turnips, etc. Fig. 9 shows detailed drawing of the construction of this pit (see Box Unit Pit, page 15).

Fundamental Principles of Storage

Condition of the Product.—The condition of vegetables when put into storage is important, because it will determine the length of time they will keep. It will also have considerable effect on flavor and edibility at the end of the storage period. Only products that are free from bruises, disease spots, insect damage, or injuries of any kind will be resistant to rots and decay during storage. Uniformity of size and condition is also desirable.

State of Maturity Important.—Root crops, such as beets, carrots, turnips, and rutabagas, should be stored before they reach full maturity, as they lose their quality and edibility if allowed to become "old" and "woody." However, cabbage, celery, Chinese cabbage, onions, squashes, pumpkins, potatoes, and sweet potatoes should be fully mature.

In order to secure proper maturity for storage, plantings must be made at the right time during the growing season. Brief planting suggestions for storage crops are given in the following pages.

Temperature and Humidity.—Most vegetables, the root crops especially, require a low temperature. About 35° F. is best. This may be difficult to secure in certain seasons, but can usually be reached by careful management. Vegetables should never be put into storage in a warm condition. A practical method of pre-cooling is to harvest them as late in the season as possible and allow them to remain outdoors during a cool night in open containers or spread on a canvas. Then place them in storage before their temperature rises the next day.

Sufficient humidity of the storage must be provided. Outdoor pits will usually maintain a sufficient amount of natural moisture in the air from the surrounding soil. Cellar storages, however, may require ventilation and sprinkling the floor with water. A layer of moist sand on the floor will frequently provide the proper humidity.

Ventilation.—Ventilation is needed principally to control temperatures in the interior of the storage. Vegetables prepared for storage are still alive, and because of this fact they generate a certain amount of heat through respiration. This heat will accumulate in the centers of large piles of vegetables, causing spoilage or the condensation of moisture. Excessive moisture is favorable to the development of rots and molds. Therefore, enough ventilation must be provided to remove this excess heat.

Provision for adequate ventilation in various types of storage structures is suggested under Methods of Storage.

Special Conditions for Storing Various Crops

Beans.—Dry navy beans, dry horticultural beans, dry limas, and the mature surplus of the green snap-bean crop from the garden are all stored successfully by allowing full maturity and thorough drying before putting them into storage. The temperature of the dry bean storage is not important, but it must be dry.

The most common storage loss of dry beans is caused by the bean weevil, which develops in the seeds under warm storage conditions. This insect is controlled by storing in a cool, dry room, by fumigation with carbon bisulfide, by dry heat, or hot water applications. For small quantities, spread the beans in pans and place them in the oven. Keep the temperature, if possible, between 130° and 140° F. for 30 minutes.

Beets.—For best storage, a temperature of 35° to 40° F. is necessary. Humidity of the storage should be high. Too low humidity will cause shriveling. This crop will store well in an outdoor pit, because the humidity is usually satisfactory in such pits. This condition may be met in the cellar storage by placing the roots on a moist earth floor. If the storage room floor is cement, it may be covered by moist sand, or the beets may be kept in crates and the floor sprinkled with water.

Beets for home storage should be planted about the middle of July.

Detroit Dark Red is a preferred variety.

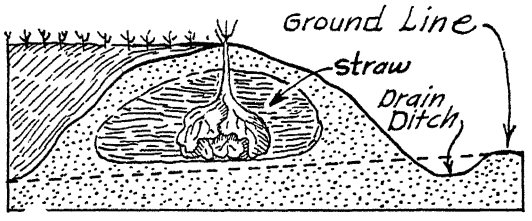

Fig. 2.—An effective and easy way to store a few extra heads of cabbage.

Cabbage.—Cabbage should be mature when stored. It can be stored in the same storage with root crops, but in such case it should be placed on shelves to allow free circulation of air, and thus prevent the gathering of water on the leaves. Storage life is 5 to 6 months.

Cellar storage for cabbage should be kept as cool as possible. The humidity should be high, but not so high that water will collect in drops on the leaves.

Cabbage can also be stored very easily in long "banks" (see Fig. 2). The entire plant is pulled and placed head down. The heads may be covered lightly with straw, but the dirt covering need not be as thick as for vegetables easily injured by freezing. From 8 inches to 1 foot of dirt is sufficient. Good drainage is essential.

Late cabbage for storage will need to be set in the field about July 1. The All-Season and Ball Head varieties store well.

Chinese Cabbage.—This vegetable may be left in the ground until late fall. It is then stored the same as other cabbage in cellars, pits, or trenches.

Chihili is the most commonly used variety. Plant the seed after August 1, or set plants about August 20.

Carrots.—Carrots are stored much the same as beets. The crop will have to be planted from July 1 to 15 in order to reach satisfactory maturity. Temperature and humidity requirements are the same as for beets.

Carrots may be used from the garden late in the fall by mulching with straw, leaves, paper, boards, or even soil. The quality remains high, and moderate freezes will not damage them.

The Danvers Half Long and Cantenay are the varieties commonly used, but Nantes and Imperator may be stored if carefully matured.

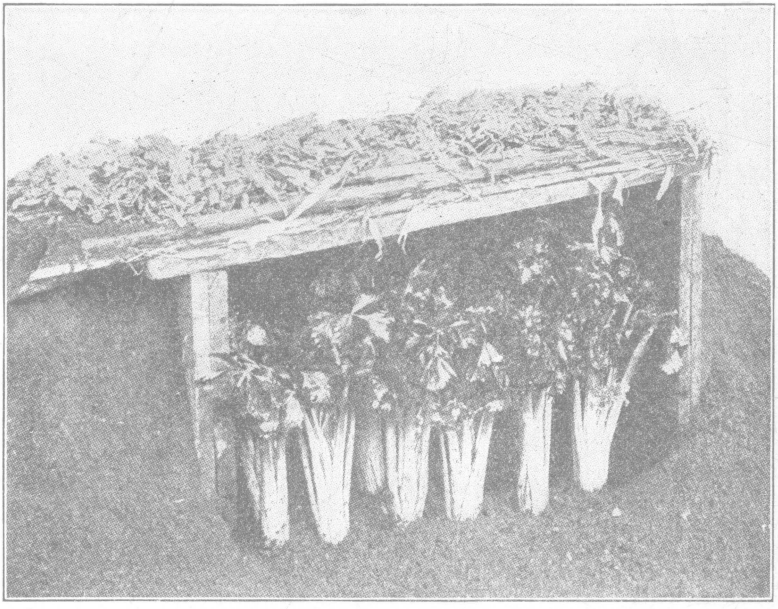

Fig. 3.—Celery can be stored in a coldframe by setting the roots in moist soil. The sides are banked with soil and manure. Boards are placed over the frame and covered with straw, leaves, or stalks, thus forming a pit. When necessary to prevent freezing, add extra covering.

Celery.—This is one of the most difficult vegetables to store, but under good conditions may be kept 3 or 4 months. It should be left in the field as late as possible without freezing. Very little blanching is required. The plants should be harvested dry, leaving a considerable portion of the root system. Care in handling is necessary to prevent bruising or breaking of the leaves. It can be stored in a cellar storage or pitted (Fig. 3). Roots should be set in about 3 inches of moist soil or sand, so placed that air can get at the center from one direction. The soil must be kept moist to prevent wilting (water the soil without getting the tops wet). Keep the temperature at all times near freezing.

Plant celery for storage about July 15 in central Ohio. It will require plenty of water. Giant Pascal and Utah are two good late varieties of the green type. Blanching is not necessary for high quality.

Onions.—Thorough curing is necessary to insure keeping quality. After the onions are pulled they are allowed to remain on the ground for a few days, and then are removed to a shed and kept in open crates for about 2 weeks to continue the curing process. After curing, they can be stored in an attic where it is cool and dry. They keep best at 32° to 36° F., but can be stored satisfactorily with sweet potatoes, pumpkins, and squashes. If onions are stored with other vegetables, these vegetables may absorb some of the onion odor. The storage period is 6 to 7 months.

Varieties commonly stored are Yellow Globe, Ebenezer, White Globe, and Red Weathersfield. Sweet Spanish is also used if it has been fully matured. A full season's growth is required for all these varieties.

Parsnips and Salsify.—These vegetables will stand freezing, and can be left in the ground over winter to be dug as needed. In addition, their quality is improved by exposure to cold weather. However, parsnips will develop a high degree of sweetness and quality in 2 or 3 weeks of near freezing temperatures, and can be removed before the final "freeze up." They may be used all through the winter.

Outdoor storage is best for both parsnips and salsify, as they lose moisture rapidly indoors. A good plan is to pile the roots on top of the ground, cover them with enough soil to prevent drying, and allow them to "freeze in." This surface storage can be opened easily at desired intervals High quality will be maintained by this method.

Parsnips and salsify require a full season's growth and must be planted in the spring.

Sweet Potatoes.—This product must be "cured" before placing in final storage. "Curing" is accomplished by placing the roots in a high temperature with excessive ventilation for a period of 10 days to 3 weeks. This drives off the excess water in the potato, causes any cuts in the skin to heal or "cork" over, and changes some of the excess starch to sugar. Commercial sweet potato storages use temperatures of from 80° to 90° F. to get a quick "cure."

The wooden floor of a barn driveway which can be opened on both ends is a good place to cure sweet potatoes for home consumption purposes. After thorough curing they may be placed in cellars or other rooms with moderate temperatures. A temperature of 50° to 55° F. with moderate humidity gives best results. Avoid bruising.

Yellow Jersey, a dry-fleshed type, and Nancy Hall, a moist-fleshed type, are the two most popular varieties. They will require the entire growing season for proper maturity.

Potatoes.—Potatoes are in their true dormant state for 2 months or more after harvest. During this resting stage they will not sprout. There is little difficulty in keeping potatoes during the fall unless they are cut, bruised, or infected with rots. In such case, special care must be taken in sorting and storing them.

During the resting stage, potatoes will remain dormant and firm at ordinary storage temperatures. After termination of this stage (for late potatoes about January 1) the temperature must be held below 41° F. to prevent sprouting. The potatoes can be held in an unheated basement or in a storage pit.

After the resting stage is broken and the temperature reaches 41° F. sprouting begins, and increases as the temperature rises. Sprouting is very rapid at 50° F. Temperatures can be lowered by ventilating on cold nights and closing the ventilators during warm days. If the potatoes are in pits when the temperature rises they should be removed. Air is essential when sprouting is rapid, or there will be a general breakdown of the tubers.

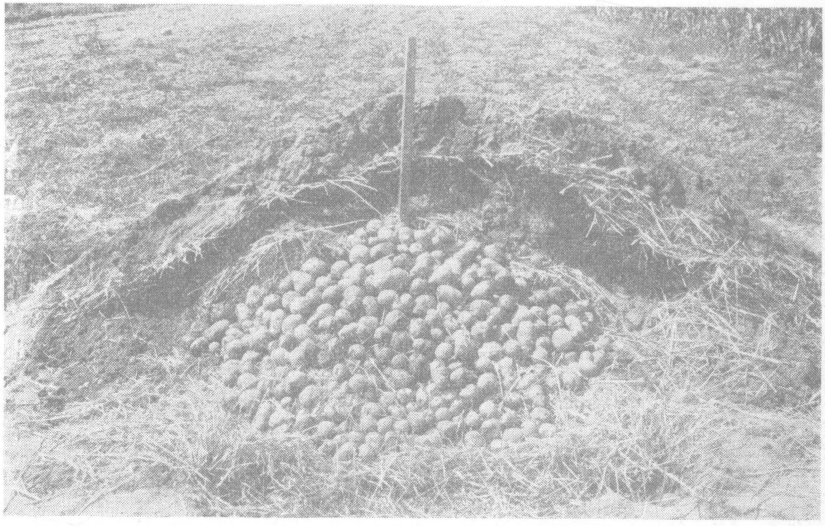

Fig. 4.—Cross section of completed pit storage for potatoes. Select a site with drainage away in all directions. If such a site is not available, dig a trench, 6 to 8 inches deep, around the pit.

The late potato crop is most convenient for home storage purposes. It is planted the latter part of May or beginning of June and remains in the ground until storage time. However, early varieties may be used by handling them in accordance with the preceding instructions. Careful attention to details insures success.

Squashes and Pumpkins.—These keep best in a dry atmosphere of 50° to 55° F. Squashes and pumpkins should be mature and a portion of the stem left on when they are stored. Care should be exercised in handling the product to prevent bruising. A rather high temperature is desirable for the first 3 weeks to harden the shells, then a lower temperature down to 50° F. will be satisfactory. Any portion of the house that is kept cool

and dry will be suitable for storing these vegetables. The storage period is 5 to 6 months.

Table Queen, Hubbard and Delicious are excellent varieties of squash for storing. They should be planted before June 1.

Tomatoes.—Tomatoes are not stored successfully, but the season may be prolonged for a month or more by pulling the vines just previous to frost. Hang the vine, roots up, in a temperature that does not go above 70° or below 50° F. The fruits will ripen a few at a time.

Another method is to pick the fruits just before frost, place them on a thick layer of straw, and cover with straw or leaves.

Tomatoes may also be wrapped and placed in a ripening room at 50° to 70° F. temperature.

Time of Storage

Vegetables should be put into storage only after the cool weather of late fall has arrived. The natural ground heat must be removed from the products before storing. This can be done by spreading them on a canvas and leaving them in an open barn driveway on cool nights, then protecting them from the higher temperatures of the daytime. Night temperatures around 40° F. are best for this purpose. Place them in the storage during the morning hours.

Some crops, of course, will stand lower temperature than others, but no crop should be allowed to freeze before it is put into storage.

The stage of maturity for best storage results should be considered in deciding about the storage of vegetables.

Summary of Storage Conditions for Various Crops

1. *Cool and moist*—Beets, carrots, parsnips, turnips, winter radishes and salsify.
2. *Cool, moderately moist*—Cabbage and celery. The atmosphere should be moist enough to prevent wilting, but not moist enough to allow accumulation of water in drops.
3. *Moderately cool and moist*—Potatoes.
4. *Cool and dry*—Onions.
5. *Warm and dry*—Pumpkins, squash and sweet potatoes.

Storage of Apples

Kind of Apples to Store

Store only carefully handpicked apples which are hard-ripe, sound, and mature. Grade carefully, immediately after picking, to remove any fruits with skin punctures, scab spots, rot, worm holes, bruises, or any other defect that might cause a breakdown in storage.

Wrapping each apple with paper is an excellent practice to reduce bruises, stem punctures, and the spread of rot from one apple to another. Newspaper or similar paper can be used for wrapping the individual apples. Oil paper wraps are best. Oil wraps prevent development of storage scald. Shredded oil paper scattered evenly through the apples at the rate of ½ pound per bushel is also a good preventive of scald and helps cushion the apples. Tender skinned varieties are best wrapped or stored with shredded paper. For such hard and tough skinned varieties as Baldwin, Rome, York, and Ben Davis, wrapping is not so essential.

Fundamental Principles for Storage

Temperature.—The best temperature for apples is 32° to 35° Fahrenheit. This is usually not attained in common storages, cellars, or pit storages until after freezing weather occurs. However, the temperature should always be below 50° F., and should remain constant over the entire period. Great temperature variations are objectionable and cause heavy losses. At 40° F. apples soften twice as fast as at 32° F. At 50° F. softening is twice as fast as at 40° F., and at 70° F. twice as fast as at 50° F. Above 70° F. apples deteriorate very rapidly.

Protection against the freezing of the fruit is necessary, because once frozen it will break down unless it is thawed out very slowly. If the walls of the storage room are sufficiently well insulated the cold will be kept out. In pit storage, the dirt covering is made thick enough to prevent frost from going through. Then, too, the dirt tends to keep an even temperature and gives protection against injury from temperature variation.

Humidity.—In order to keep the fruit plump and free from shrivelling, the storage must have a high humidity. A storage room with a ground floor, or pit storages, usually provide enough moisture, but buildings with concrete floors are too dry unless water is sprinkled on the floor or large open pans of water are placed near the stacked fruit. A high relative humidity is very desirable and for best results it should be 85 per cent or more.

Ventilation.—For common storages, cellar storage, and pit storage, cooling is secured by ventilation. Quick cooling during cool nights must be provided. During warm days ventilating openings can be closed. When temperatures of the fruit are higher than desirable, it is especially important that ventilation be provided at every favorable opportunity to cool the fruit down to desirable storage temperature.

Odors.—Apples readily absorb odors from other commodities stored in the same compartment. Vegetables such as onions, cabbage, or potatoes cannot safely be stored with apples. Building materials carrying objectionable odors should be kept out of storage construction; creosoted materials, for example, will impart a creosote flavor to apples. Endeavor to keep all objectionable foreign odors from contaminating the apple flavor.

Apple Varieties as Related to Storage

Some varieties deteriorate rapidly after picking unless placed promptly in cold storage at 32° F., and so are not well adapted to home storage. Varieties in this class are McIntosh, Delicious, Northern Spy, and Golden Delicious.

Grimes Golden and Jonathans have rather short storage life, and are best consumed during the fall and early winter. The small sizes hold up in storage longer than the large sizes. Mature, large Jonathans are quickly broken down by high temperatures and develop Jonathan spot.

Varieties such as Baldwin, Stayman, Rome, York, Ben Davis, and Gano are well adapted to home storage handling throughout the winter months and into early spring.

Many other varieties fall into one of these three classes, and should be stored and used accordingly.

Time of Storage

Apples need to be stored immediately after harvest. If they are allowed to remain in warm temperatures, they break down quickly and their storage life is shortened.

For best results, leave the apples out-of-doors over a cool night to reduce their temperature as much as possible before storing. Then put them in storage early the following morning. In this way the heat of the day is not carried in with the fruit, and the storage functions to better advantage. Prompt cooling is essential to long storage life with fruits.

For storing in cellars, pits, or common storage, it is best to let the apples hang on the trees as long as possible without serious loss from dropping. During warm weather, apples will keep better if allowed to remain on the trees than if placed in a warm storage.

Storage of Pears

Only long keeping winter varieties of pears are adapted to home storage, such as Winter Nellis, Lawrence, Buerré d'Anjou and Kieffer. Pick when very firm and before any yellowing develops. Handle very carefully to prevent bruising. Pears keep best when the individual fruits are wrapped with paper.

Cellar Storage

A cellar under the dwelling or some outbuilding is the most desirable place to store most fruits and vegetables, provided the temperature and humidity can be regulated. If there is a furnace or other heater in the cellar an insulated partition can be built to separate off a corner with a window (preferably a north exposure). The window may also need to be insulated, but it should be adjusted in order to admit cold air for the regulation of temperature and to provide ventilation when needed. The humidity of such a storage may be controlled by sprinkling the floor with water or by placing a 3- or 4-inch layer of moist sand on the floor. This is more likely to be necessary where there is a cement floor.

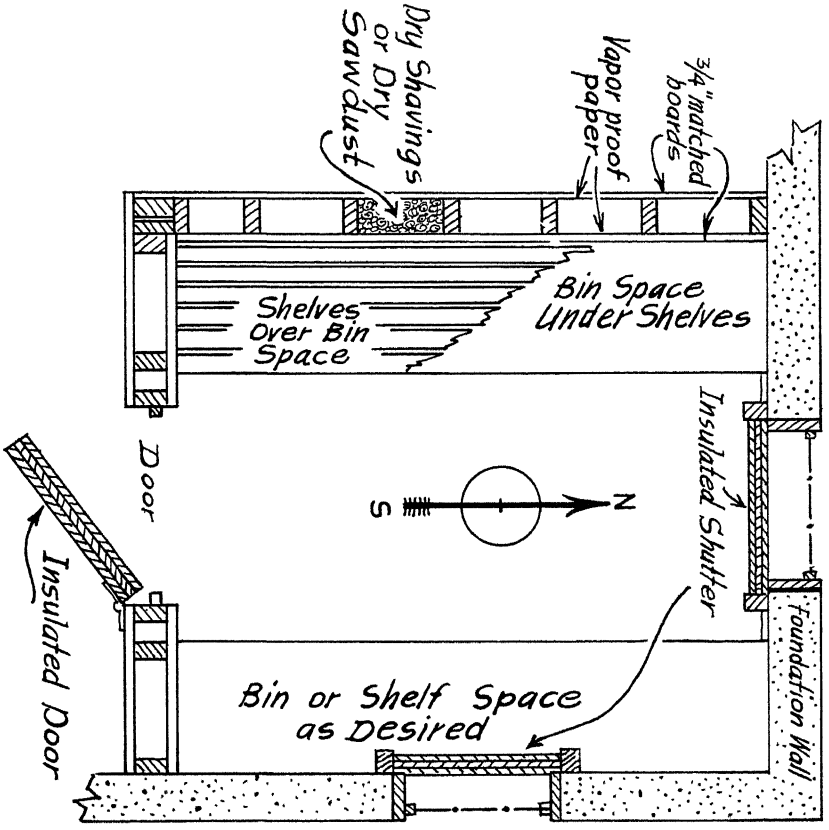

Fig. 5.—Suggested floor plan for a storage room in corner of the cellar. The insulated shutters (made of three pieces of vapor-proof insulation board) are adjustable for regulating cold air intake.

In some cases the cellar wall will also need to be insulated, as stone or cement walls will conduct the natural heat of the earth into the storage. Overhead insulation will also be necessary for best results.

A very practical type of insulating partitions and walls is to place vapor-proof paper on each side of the 2- by 4-inch studding, and cover with sheathing. The space between the studding is then packed with dry saw-

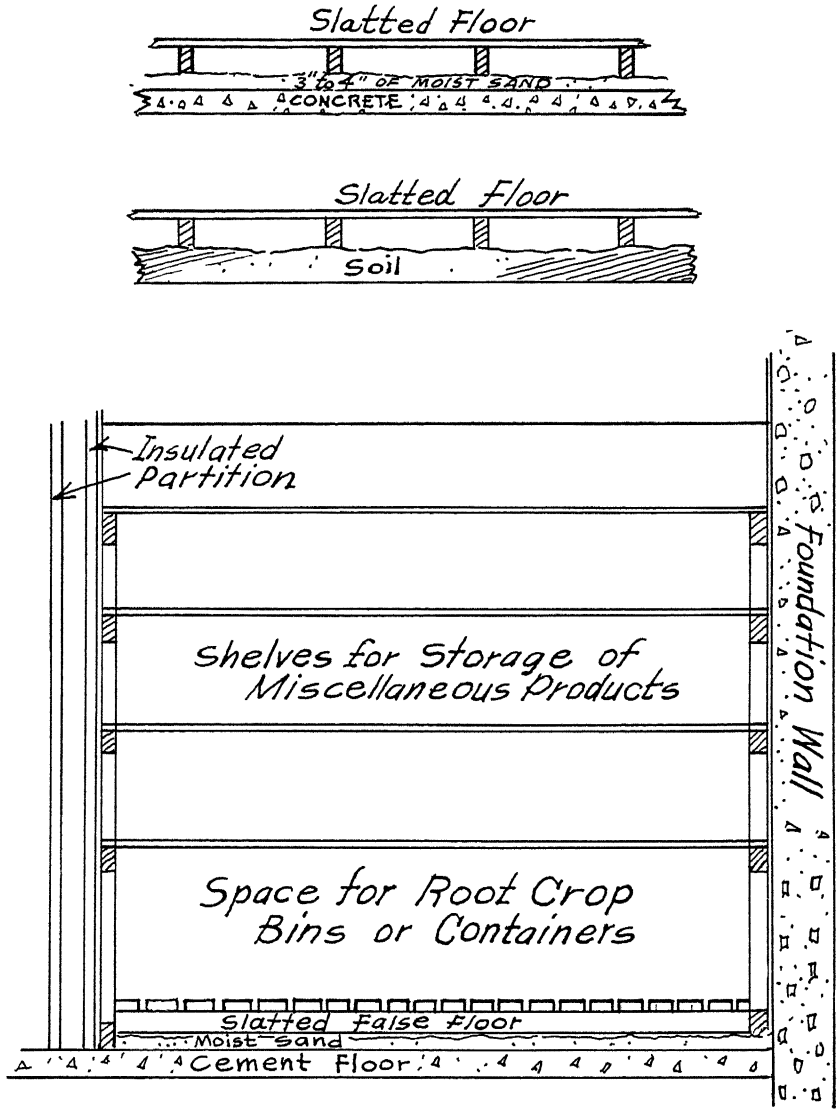

Fig 6.—Diagram of sidewall shelving in cellar storage. The slatted floor improves air circulation under stored products and helps secure proper conditions of humidity The two illustrations at top show two methods of construction—one on a concrete floor, and the other on an earth floor.

dust which has been treated with 1 pound of hydrated lime to each bushel of sawdust. The lime will prevent insects, rodents, and mold from damaging the sawdust.

The details of the interior arrangement of cellar storages such as this should be decided upon by the individual family, and will depend upon the type of products to be stored. For instance, root crops will usually require bins or ground space. Cabbage will need shelving, and celery will need some moist earth in which to set the roots. Various other products will, of course, require specific equipment.

Outdoor Pits

Apples, root crops, potatoes, and cabbage may be stored in pits without deterioration of the product, if directions regarding conditions of storage are followed.

The size of the pit should depend upon the quantity of vegetables that will be removed at any one time. It is better to have several small pits than one large one. There is much more danger of loss when only a portion is removed and the pit again closed.

Generally, several vegetables can be stored in the same pit and divided by boards or straw. Then, when the pit is opened, a variety of vegetables is available. These can be removed to a cellar, if one is available, or the surplus can be placed in a barrel storage described and illustrated on pages 13-14.

Apples can be held in good condition in common pit storage similar to that shown in Fig. 1. Do not store vegetables in the same pit with apples, as apples rapidly absorb any foreign flavors.

Fig. 7.—The horizontal barrel storage is liked for apples and can be used for vegetables as well. It is easy to keep the contents clean with this type of storage. The barrels are filled, then laid end to end in a trench over a bed of straw or leaves. A trench that will let the barrels down about half their diameter is sufficient. Select a location where surface water will drain away. A box may also be used. This method is especially suitable to back yards and city gardens.

Bulk Storage Pit.—Select a well drained location, preferably with a sandy soil where there is a slight elevation to provide good drainage away from the pit. A trench dug around the pit will usually furnish good drainage. The common method is to dig a pit 6 to 8 inches deep and fill it with straw, hay, or dried leaves. The apples or vegetables are then placed on this material in a conical heap, preferably not over 3 feet high. With fruits which must be kept clean, cover first with clean burlap, carpeting, or heavy paper, then cover with 6 to 8 inches of the same material as used under the fruit. Enough soil should then be placed over this layer to hold it in place and shed water.

A small wooden spout can be placed in the center of the pile and left to extend above the outer covering (see Fig. 1). A thermometer is lowered on a string into this spout to get temperature. As cold weather approaches and the temperature of the pit nears 35° F., add enough more soil to make this layer a foot thick.

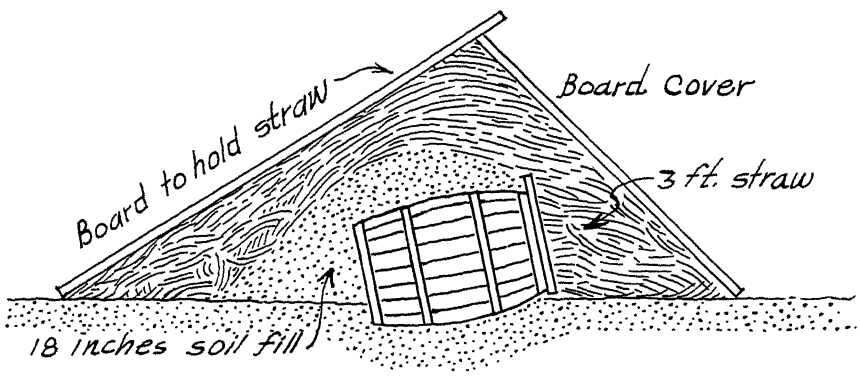

Fig. 8.—A suggestion for a "barrel pit" for either vegetables or apples.

After heavy freezing, add a second layer of straw and cover with another foot of soil. In this way the frozen soil is buried deep, and the alternate freezing and thawing during the winter will not affect the inside temperature to any great extent. Potatoes stored in pits should not reach a temperature lower than 38° F. before the pit is finally covered for the winter. If the temperature of the pit is not taken before making the final covering, it will be wise to furnish ample ventilation by placing a spout or a tuft of straw or hay, etxending through the top of the pit.

When the pit is first made cover some soil near the pit with straw or strawy manure. Then, after freezing weather, this cover can be removed and unfrozen soil secured under it for the final covering.

Trenches.—An adaptation of the bulk pit is the trench method. In this case the vegetables are placed in a long, narrow, and shallow trench which has been lined with straw. The trench is then sealed by the same method as the pit. It must be placed in a very well drained location.

Horizontal Barrel Storage Pit.—Where storage for the contents of more than one barrel is wanted, the horizontal barrel pit can be used. With this method barrels are placed horizontally, end to end, and covered as described in building a pit, or with earth and straw as in sketch. When the contents of one barrel is used, the barrel is removed and the next one opened. A burlap cover can be used over the end of each barrel in place of the usual wooden head; it is more convenient to open.

Barrel or box pits are easily constructed and for this reason have been very popular. Apples and vegetables are kept clean and in good usable condition stored in this way (see Figs. 7 and 8).

The Box Unit Pit.—This pit is used where it is desirable to remove small portions of the stored products at frequent intervals. With this method

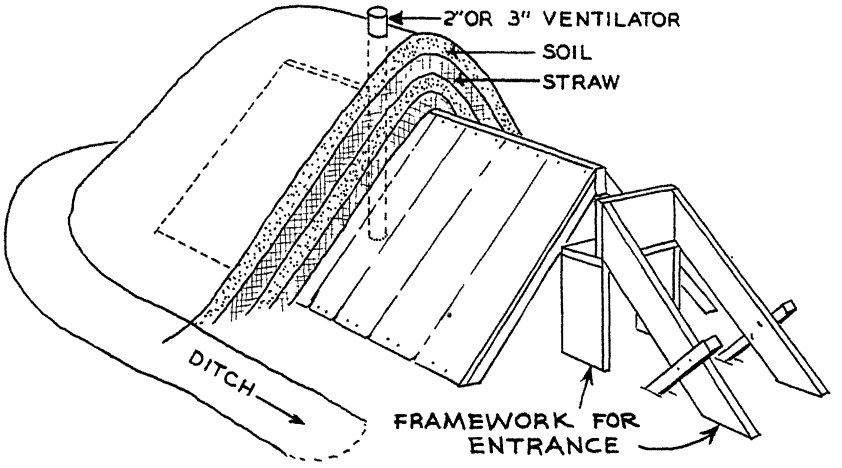

Fig. 9.—Suggested design for construction of a box unit pit. Note the entrance framework, which makes it easy to remove the products.

a 1- or 2-weeks' supply of a vegetable is placed in a small box, carton, or basket. Different vegetables may be placed in separate boxes, thereby furnishing a variety when the pit is opened. The total supply is put in the pit before covering. Do not allow the pit to remain open after removing a portion of the products.

In this type of pit a supporting framework must be constructed over the vegetables or fruits to prevent the weight of the covering earth from resting on the contents (see Fig. 1). This framework may be constructed out of scrap lumber. It consists mainly of an ordinary trestle, with boards laid against the sides. This forms an A-type housing over the products. The entrance framework is made by nailing together three 18-inch pieces of 12-inch board, forming three sides of a square. This is placed, open side down, against the front of the main framework. A baffle board is then placed on the front edge of door framework to prevent the covering soil from falling into the entrance. Necessary bracing is attached. Cover with

straw and soil. After structure is completed the entrance is closed by stuffing it with a large amount of straw or hay.

The ventilator is used primarily for lowering a thermometer into the pit to check the temperature from time to time. The top of the ventilator should be kept closed except when interior temperature is too high.

Homemade Caves.—This type of storage is adapted to hillside locations and where structures of a permanent or semi-permanent kind are desired. The excavation for the cave is recessed well into the hillside and some sort of strong walls constructed. Such walls may be built of stone, or cement blocks. These materials are good conductors of earth heat, and insulation may be necessary, as described under Cellar Storage.

Overhead insulation is secured by the use of 2- by 8-inch joists which are sealed on the bottom with vapor-proof paper and sheathing. The spaces between the joists are filled with dry sawdust treated with hydrated lime, 1 pound to each bushel of sawdust. Vapor-proof paper and sheathing are then placed over the top of the joists and a roof constructed over the entire structure. This method eliminates the necessity of mounding heavy amounts of soil over the top of the cave, which would require very strong overhead support.

The inside measurements of a cave are usually 6 to 8 feet wide and 10 to 15 feet long. These dimensions may be varied to suit the needs of the family.

Ventilation is necessary in caves in order to regulate the interior temperature. A ventilating flue at the closed end will serve the purpose.

Up-Ground Storage.—These types are used on level land where drainage is a problem. They are permanent buildings and require careful designing to insure best results. However, outdoor kitchens or unused rooms may be converted into satisfactory up-ground storages by proper insulation and ventilation. Detailed plans for up-ground storages may be secured through the local County Agricultural Agent.

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